Complete Summary

GUIDELINE TITLE

ACR Appropriateness Criteria™ for spine trauma.

BIBLIOGRAPHIC SOURCE(S)

Anderson RE, Drayer BP, Braffman B, Davis PC, Deck MD, Hasso AN, Johnson BA, Masaryk T, Pomeranz SJ, Seidenwurm D, Tanenbaum L, Masdeu JC. Spine trauma. American College of Radiology. ACR Appropriateness Criteria. Radiology 2000 Jun;215(Suppl):589-95. [10 references]

COMPLETE SUMMARY CONTENT

SCOPE

DISEASE/CONDITION(S)

Spine trauma

GUIDELINE CATEGORY

Diagnosis

CLINICAL SPECIALTY

Emergency Medicine
Neurological Surgery
Neurology
Orthopedic Surgery
Radiology

INTENDED USERS

Health Plans
Hospitals
Managed Care Organizations
Physicians
Utilization Management

GUIDELINE OBJECTIVE(S)

To evaluate the appropriateness of initial radiologic examinations for spine trauma

TARGET POPULATION

Patients with spine trauma

INTERVENTIONS AND PRACTICES CONSIDERED

1. Plain x-ray:
    - Anteroposterior
    - Lateral
    - Dens
    - Swimmers as needed for T1
    - Flexion/extension
    - Obliques
2. Computed tomography (optional: sagittal reconstructions)
3. Myelography computed tomography
4. Magnetic resonance imaging

MAJOR OUTCOMES CONSIDERED

Utility of radiologic examinations in differential diagnosis

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

The guideline developer performed literature searches of recent peer-reviewed medical journals, primarily using the National Library of Medicine's MEDLINE database. The developer identified and collected the major applicable articles.

NUMBER OF SOURCE DOCUMENTS

The total number of source documents identified as the result of the literature search is not known.

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Expert Consensus (Delphi Method)
Weighting According to a Rating Scheme (Scheme Not Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not applicable

METHODS USED TO ANALYZE THE EVIDENCE

Systematic Review with Evidence Tables

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

One or two topic leaders within a panel assume the responsibility of developing an evidence table for each clinical condition, based on analysis of the current literature. These tables serve as a basis for developing a narrative specific to each clinical condition.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus (Delphi)

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Since data available from existing scientific studies are usually insufficient for meta-analysis, broad-based consensus techniques are needed to reach agreement in the formulation of the Appropriateness Criteria. Serial surveys are conducted by distributing questionnaires to consolidate expert opinions within each panel. These questionnaires are distributed to the participants along with the evidence table and narrative as developed by the topic leader(s). Questionnaires are completed by the participants in their own professional setting without influence of the other members. Voting is conducted using a scoring system from 1-9, indicating the least to the most appropriate imaging examination or therapeutic procedure. The survey results are collected, tabulated in anonymous fashion, and redistributed after each round. A maximum of three rounds is conducted and opinions are unified to the highest degree possible. Eighty (80) percent agreement is considered a consensus. If consensus cannot be reached by this method, the panel is convened and group consensus techniques are utilized. The strengths and weaknesses of each test or procedure are discussed and consensus reached whenever possible.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria and the Chair of the ACR Board of Chancellors.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

ACR Appropriateness Criteria™

Clinical Condition: Spine Trauma

Variant 1: Cervical spine trauma: asymptomatic, alert, normal exam.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Plain X-rays		
• Anteroposterior, Lateral, Dens	2	
• Swimmers as needed for T1	2	
Added Views		
• Flexion/extension	2	
• Obliques	2	
Computed tomography (optional: sagittal reconstructions)	2	
Magnetic resonance imaging	2	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9		

1=Least appropriate 9=Most appropriate

Clinical Condition: Spine Trauma

Variant 2: Cervical spine trauma: multiple trauma and/or impaired sensorium.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Plain X-rays		
• Anteroposterior, Lateral, Dens	8	Thin section computed tomography may be substituted.
• Swimmers as needed for T1	8	
Added Views		
• Flexion/extension	4	
• Obliques	4	Selected cases only.
Computed tomography (optional: sagittal reconstructions)	4	Should be performed if x-rays equivocal or positive or if part of multitrauma protocol.
Magnetic resonance imaging	3	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Clinical Condition: Spine Trauma

Variant 3: Cervical spine trauma: neck pain, no neurological deficit.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Plain X-rays		
• Anteroposterior, Lateral,	8	

Dens		
• Swimmers as needed for T1	8	
Added Views		
• Flexion/extension	4	
• Obliques	4	Perform if suspicion on anteroposterior lateral views.
Computed tomography (optional: sagittal reconstructions)	4	
Magnetic resonance imaging	4	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Clinical Condition: Spine Trauma

Variant 4: Cervical spine trauma: severe pain, normal plain films, no neurological deficit.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Computed tomography (optional: sagittal reconstructions)	6	
Added Views		
• Flexion/extension	6	Indicated unless unstable fracture suspected.
• Obliques	5	
Magnetic resonance imaging	4	Perform if severe soft tissue injury or if radicular pain is suspected.

Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate

Clinical Condition: Spine Trauma

Variant 5: Cervical spine trauma: equivocal or positive plain films, no neurological deficit.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Computed tomography (optional: sagittal reconstructions)	8	
Added Views		
• Flexion/extension	6	Indicated unless unstable fracture suspected.
• Obliques	6	
Magnetic resonance imaging	4	Perform if severe soft tissue injury or if radicular pain is suspected.
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Clinical Condition: Spine Trauma

Variant 6: Cervical spine trauma: equivocal or positive plain films with neurological deficit.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Computed tomography (optional: sagittal reconstructions)	8	If penetrating thecal sac or root sleeve avulsion is suspected, myelography computed tomography might

		be performed.
Magnetic resonance imaging	8	
Added Views		
• Flexion/extension	4	Reserve for problem solving.
• Obliques	4	Reserve for problem solving.
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Clinical Condition: Spine Trauma

Variant 7: Thoracic spine trauma: severe trauma, pain, no neurological deficit.

Radiologic Exam Procedure	Appropriateness Rating	Comments
X-rays		
• Anteroposterior, Lateral	8	
• Swimmers as needed for T1	8	
Computed tomography (optional: sagittal reconstructions)	6	If radicular or focal pain present.
Magnetic resonance imaging	4	Unless radicular or focal pain.
Myelography computed tomography	4	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Clinical Condition: Spine Trauma

Variant 8: Thoracic spine trauma: equivocal or positive plain films, no neurological deficit.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Computed tomography (optional: sagittal reconstructions)	8	
Magnetic resonance imaging	4	Might be performed if focal or radicular pain.
Myelography computed tomography	3	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Clinical Condition: Spine Trauma

Variant 9: Thoracic spine trauma: with neurological deficit.

Radiologic Exam Procedure	Appropriateness Rating	Comments
X-rays		
Anteroposterior, Lateral	8	
Swimmers as needed for T1	8	
Computed tomography (optional: sagittal reconstructions)	8	
Magnetic resonance imaging	8	
Myelography computed tomography	3	If penetrating thecal sac injury is suspected and/or magnetic resonance imaging is not conclusive.
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Clinical Condition: Spine Trauma

Variant 10: Lumbar spine trauma: pain, tenderness.

Radiologic Exam Procedure	Appropriateness Rating	Comments
X-rays: Anteroposterior, Lateral	7	
Computed tomography (optional: sagittal reconstructions)	4	
Magnetic resonance imaging	4	
Myelography computed tomography	2	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Clinical Condition: Spine Trauma

Variant 11: Lumbar spine trauma: severe trauma, normal plain films, no radicular symptoms.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Computed tomography (optional: sagittal reconstructions)	3	
Magnetic resonance imaging	3	
Myelography computed tomography	2	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Clinical Condition: Spine Trauma

Variant 12: Lumbar spine trauma: trauma, neurological deficit.

Radiologic Exam Procedure	Appropriateness Rating	Comments
X-rays: Anteroposterior, Lateral	8	
Computed tomography (optional: sagittal reconstructions)	6	In select cases, both computed tomography and magnetic resonance imaging may be appropriate.
Magnetic resonance imaging	6	In select cases, both computed tomography and magnetic resonance imaging may be appropriate
Myelography computed tomography	4	If penetrating thecal sac injury is suspected and/or magnetic resonance imaging is not conclusive.
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Clinical Condition: Spine Trauma

Variant 13: Lumbar spine trauma: seat belt (chance) fracture.

Radiologic Exam Procedure	Appropriateness Rating	Comments
X-rays: Anteroposterior, Lateral	8	
Computed tomography (optional: sagittal reconstructions)	8	
Magnetic resonance imaging	5	If focal, radicular findings or other neurologic deficit.
Myelography computed tomography	4	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Summary

The cervical spine is the most vulnerable segment of the spine and therefore receives emphasis in the guideline document.

Immobilization of the neck is a common practice when aiding an injured person at the scene of an accident. A daily problem for emergency department personnel therefore is how to "clear" the cervical spine, both in cases where spinal injury is the only question and in the context of multiple trauma.

No imaging is needed in patients who have no neck symptoms, who are alert, cooperative, non-tender, and not intoxicated.

If these strict criteria are not met, plain x-rays remain the mainstay of the initial imaging evaluation. The exam should include lateral (including T1), anteroposterior and odontoid views. Swimmers view for T1 is frequently needed, especially in males. However, a false negative rate for plain film studies as high as 20% and false positive rate of 40% have been reported. In a study of 740 patients, the most common cause for missed fractures and subluxations was poor film quality, not interpretation errors.

Plain film imaging beyond anteroposterior and lateral views may be useful in selected cases. Supine oblique studies aid in examining lateral masses. Flexion and extension views in patients with severe pain and tenderness but with normal plain x-rays are commonly done. These additional studies are not generally advocated for routine protocols.

Computed tomography scanning of the spine provides an additional method to:

- diagnose fractures suspected on clinical grounds in the case of normal or equivocal plain x-rays; and
- further characterize injuries seen on plain films.

Computed tomography scan images have limitations. Fractures in the axial plane including base of odontoid and some subluxations may not be readily apparent. Sagittal reconstructions from thinly spaced, overlapping, or spiral scan images will be very helpful in evaluating compression fractures and subluxations.

Magnetic resonance imaging should be reserved for cases of known or suspected soft tissue injuries such as disc herniations, ligament tears, epidural hematoma, and spinal cord edema or hematoma, especially in the presence of a neurological deficit. Magnetic resonance imaging is not adequate for evaluation of bony trauma. Myelography with computed tomography should be used in place of magnetic resonance imaging only if magnetic resonance imaging is not available and the patient cannot be safely transferred to a center with magnetic resonance imaging facilities. However, since the inherent risks of patient manipulation required to accomplish the myelogram and postmyelogram computed tomography are considerable, it is likely that supervised transport to a magnetic resonance imaging facility will pose less risk to the patient.

Thoracic and lumbar imaging guidelines generally follow the cervical pattern. Magnetic resonance imaging will probably be used more often in thoracic spine injuries, since as many as 50% of these patients will have neurological deficits.

Lumbar spine fractures are most often vertebral body compression injuries. One variation is the seat belt or chance fracture which results from a severe distraction force. These injuries may be less evident on computed tomography due to their horizontal orientation. Magnetic resonance imaging will be useful to assess the degree of ligamentous rupture in these injuries, in addition to other soft tissue injuries.

CLINICAL ALGORITHM(S)

Algorithms were not developed from criteria guidelines.

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The recommendations are based on analysis of the current literature and expert panel consensus.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Appropriate selection of radiologic exam to diagnose cervical, thoracic, and lumbar traumas of the spine.

POTENTIAL HARMS

A false negative rate for plain film studies as high as 20% and false positive rate of 40% have been reported.

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

An American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those exams generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made

by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better

IOM DOMAIN

Effectiveness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Anderson RE, Drayer BP, Braffman B, Davis PC, Deck MD, Hasso AN, Johnson BA, Masaryk T, Pomeranz SJ, Seidenwurm D, Tanenbaum L, Masdeu JC. Spine trauma. American College of Radiology. ACR Appropriateness Criteria. Radiology 2000 Jun;215(Suppl):589-95. [10 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

1999

GUIDELINE DEVELOPER(S)

American College of Radiology - Medical Specialty Society

SOURCE(S) OF FUNDING

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria™.

GUIDELINE COMMITTEE

ACR Appropriateness Criteria™ Committee, Expert Panel on Neurologic Imaging

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Names of Panel Members: Thomas Masaryk, MD; Burton P. Drayer, MD; Robert E. Anderson, MD; Bruce Braffman, MD; Patricia C. Davis, MD; Michael D. F. Deck, MD; Anton N. Hasso, MD; Blake A. Johnson, MD; Stephen J. Pomeranz, MD; David Seidenwurm, MD; Lawrence Tanenbaum, MD; Joseph C. Masdeu, MD, PhD

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

This is the current release of the guideline.

The ACR Appropriateness Criteria™ are reviewed after five years, if not sooner, depending upon introduction of new and highly significant scientific evidence. The next review date for this topic is 2004.

GUIDELINE AVAILABILITY

Electronic copies: Available from the American College of Radiology (ACR) Web site.

Print copies: Available from ACR, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

AVAILABILITY OF COMPANION DOCUMENTS

None available

PATIENT RESOURCES

None available

NGC STATUS

This summary was completed by ECRI on July 31, 2001. The information was verified by the guideline developer as of August 24, 2001.

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